

## ABSTRACT

System and method for radiographic imaging of tissue using a non-radioactive, radio-opaque imaging agent that accumulates intracellularly in tissue in proportion to its functional, or physiological, activity. In one embodiment, the imaging agent is a cell-membrane permeable, radio-opaque, high affinity ligand for the intracellular enzyme hexokinase. The imaging agent is administered to a patient, and after an accumulation interval, radiographic images are acquired. The imaging agent preferentially accumulates in malignant tissue and increases its radio-opacity because of its elevated glucose metabolic rate relative to benign and normal tissue. The tissue being examined is transilluminated by X-ray beams with preselected different mean energy spectra, and a separate radiographic image is acquired during transillumination by each beam. An image processing system performs a weighted combination of the acquired images to produce a single displayed image. The image processing procedure isolates the radiographic density contributed solely by differential accumulation of the imaging agent in malignant, benign, and normal tissue. The system and method thus provides a functional image displayed with the anatomical detail and spatial resolution of a radiographic image. The viewer may interactively control the relative proportion of radiographic density contributed by imaging agent, soft tissue, and bone to the displayed image, allowing the display of functional and anatomical information in complete registration, and facilitating localization of malignant tissue in relation to nearby anatomical structures. In other embodiments, the system and method may be used to detect enzymes, nucleic acids, coenzymes, fatty acids, and other cellular targets in diagnostic imaging applications.